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Panel Proposes Streamlining Math

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American students' math achievement is "at a mediocre level" compared with that of their peers worldwide, according to a new report by a federal panel. The panel said that math curriculums from preschool to eighth grade should be streamlined to focus on key skills — the handling of whole numbers and fractions, and certain aspects of geometry and measurement — to prepare students to learn algebra.

"The sharp falloff in mathematics achievement in the U.S. begins as students reach late middle school, where, for more and more students, algebra course work begins," said the report of the National Mathematics Advisory Panel, appointed two years ago by President Bush. "Students who complete Algebra II are more than twice as likely to graduate from college, compared to students with less mathematical preparation."

The report, to be released Thursday, spells out specific goals for students. For example, it says that by the end of the third grade, students should be proficient in adding and subtracting whole numbers; two years later, they should be proficient in multiplying and dividing them. By the end of sixth grade, it says, students should have mastered the multiplication and division of fractions and decimals.

The report tries to put to rest the long and heated debate over math teaching methods. Parents and teachers in school districts across the country have fought passionately over the relative merits of traditional, or teacher-directed, instruction, in which students are told how to solve problems and then are drilled on them, as opposed to reform or child-centered instruction, which emphasizes student exploration and conceptual understanding. The panel said both methods have a role.

"There is no basis in research for favoring teacher-based or student-centered instruction," said Dr. Larry R. Faulkner, the chairman of the panel, at a briefing for reporters on Wednesday. "People may retain their strongly held philosophical inclinations, but the research does not show that either is better than the other."

Districts that have made "all-encompassing decisions to go one way or the other," he said, should rethink those decisions, and intertwine different methods of instruction to help students develop a broad understanding of math.

"To prepare students for algebra, the curriculum must simultaneously develop conceptual understanding, computational fluency and problem-solving skills," the report said. "Debates regarding the relative importance of these aspects of mathematical knowledge are misguided. These capabilities are mutually supportive,."

The president convened the panel to advise on how to improve math education for the nation's children. Its members include math and psychology professors from leading universities, a middle-school math teacher and the president of the National Council of Teachers of Mathematics.

Closely tracking an influential 2006 report by the National Council of Teachers of Mathematics, the panel said that the math curriculum should include fewer topics, and then spend enough time on each of them to make it is learned in depth and need not be revisited in later grades. This is how top-performing nations approach the curriculum.

After a similar advisory panel on reading made its recommendations in 2000, the federal government used the report as a guide for awarding \$5 billion in federal grants to promote reading proficiency.

The new report does not call for a national math curriculum, or for new federal investment in math instruction. It does call for more research on successful math teaching, and recommends that the Secretary of Education convene an annual forum of leaders of the national associations concerned with math to develop an agenda for improving math instruction.

The report cites a number of troubling international comparisons, including a 2007 assessment finding that 15-year-olds in the United States ranked 25th among their peers in 30 developed nations in math literacy and problem solving.

The report says that Americans fell short, especially, in handling fractions. It pointed to the [National Assessment of Educational Progress](#), standardized-test results that are known as the nation's report card, which found that almost half the eighth graders tested could not solve a word problem that required dividing fractions.

After hearing testimony and comments from hundreds of organizations and individuals, and sifting through 16,000 research publications, the panelists shaped their report around recent research on how children learn.

For example, the panel found that it is important for students to master their basic math facts by heart.

“For all content areas, practice allows students to achieve automaticity of basic skills — the fast, accurate, and effortless processing of content information — which frees up working memory for more complex aspects of problem solving,” the report said.

Dr. Faulkner, a former president of the University of Texas at Austin, said the panel “buys the notion from cognitive science that kids have to know the facts.”

“In the language of cognitive science, working memory needs to be predominately dedicated to new material in order to have a learning progression, and previously addressed material needs to be in long-term memory,” he said.

The report also cites recent findings that students who depend on their native intelligence learn less than those who believe that success depends on how hard they work. Dr. Faulkner said the current “talent-driven approach to math, that either you can do it or you can’t, like playing the violin” needed to be changed.

“Experimental studies have demonstrated that changing children’s beliefs from a focus on ability to a focus on effort increases their engagement in mathematics learning, which in turn improves mathematics outcomes,” the report says “When children believe that their efforts to learn make them ‘smarter,’ they show greater persistence in mathematics learning.”

The report makes a plea for shorter and more accurate math textbooks. Given the shortage of elementary teachers with a solid grounding in math, the report recommends further research on the use of math specialists to teach several different elementary grades, as is done in many top-performing nations.

The report also recommends a revamping of the math content on the national assessment test, to focus on the same skills that the report emphasizes.

Here are the panel’s recommended benchmarks for elementary school math education:

Benchmarks in Math Education Fluency With Whole Numbers

1 By the end of Grade 3, students should be proficient with the addition and subtraction of whole numbers.

2 By the end of Grade 5, students should be proficient with multiplication and division of whole numbers.

Fluency With Fractions

1 By the end of Grade 4, students should be able to identify and represent fractions and decimals, and compare them on a number line or with other common representations of fractions and decimals.

2 By the end of Grade 5, students should be proficient with comparing fractions and decimals and common percents, and with the addition and subtraction of fractions and decimals.

3 By the end of Grade 6, students should be proficient with multiplication and division of fractions and decimals.

4 By the end of Grade 6, students should be proficient with all operations involving positive and negative integers.

5 By the end of Grade 7, students should be proficient with all operations involving positive and negative fractions.

6 By the end of Grade 7, students should be able to solve problems involving percent, ratio, and rate and extend this work to proportionality.

Geometry and Measurement

1 By the end of Grade 5, students should be able to solve problems involving perimeter and area of triangles and all quadrilaterals having at least one pair of parallel sides (i.e., trapezoids).

2 By the end of Grade 6, students should be able to analyze the properties of two-dimensional shapes and solve problems involving perimeter and area, and analyze the properties of three dimensional shapes and solve problems involving surface area and volume.

3 By the end of Grade 7, students should be familiar with the relationship between similar triangles and the concept of the slope of a line.

Source: National Mathematics Advisory Panel, 2008.